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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF ALLEN COUNTY, INDIANA

JUNE, 1966

NO. 10

by

D. G. SHURIG

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

Final Report

AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF

ALLEN COUNTY, INDIANA

TO: Dr. G. A. Leonards, Director
Joint Highway Research Project

June 23, 1966

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

File: 1-5-2B-37
Project: C-36-51B

The attached report, entitled "Airphoto Interpretation of Engineering Soils of Allen County, Indiana," completes a portion of the project concerned with development of county engineering soils maps of the State of Indiana. This is the 37th report in the series. The report was prepared by D. C. Shurig, Research Associate, Joint Highway Research Project.

The soils mapping of Allen County was performed primarily by using annotated aerial photographs produced as field surveys by the Soil Conservation Service. Several soil profiles were sampled by the Soil Conservation Service and the Indiana State Highway Commission. Engineering test data on various soil horizons are included in the report. The Engineering Soils Map is presented as a blackline print.

Respectfully submitted,

H. L. Michael/jgs

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Associate Director

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Final Report

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By
D. G. Shurig
Research Associate

Joint Highway Research Project

Project: C-36-51B

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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS

OF

ALLEN COUNTY, INDIANA

by

D. G. Shurig

INTRODUCTION

Development of an engineering soils map of Allen County (in back-cover pocket of this report) was the primary objective of this project. The purpose of the following report is to supplement the information appearing on the engineering soils map.

The engineering soils map was prepared primarily from pedological soils data. The pedological soils data consisted mainly of annotated aerial photographs which were marked in great detail during a field soil survey of Allen County by the United States Department of Agriculture (Soil Conservation Service in cooperation with Purdue University, Agricultural Experiment Station)(9).

The aerial photographs used to delineate boundaries for the engineering soils map were contact prints 9 by 9 inches or 7 by 9 inches in size. The approximate scale was 1:20,000. The aerial photographs were obtained in 1938 and 1951. The field agricultural soil survey was performed between 1951 and 1961. Annotations were made on the 1951 aerial photographs.

Numerical symbols on the Annotated photographs indicated soil texture, soil catena, drainage profile, slope class, and erosional class according to USDA classification systems. The catena number, plus the drainage profile number, indicates the soil series. Delineating various individual soil series, and groups of soil series, was the primary technique used in developing parent material boundaries on the engineering soils map.

The use of pedological data was supplemented with routine airphoto interpretation techniques. Several days were spent in the field verifying judgements pertaining to pedological data and airphoto interpretation.

Field sampling was done by the USDA soil scientists. At each of the 16 sites sampled, samples for laboratory testing were usually taken from the A-, B-and C-horizons. Due to the obviously bad construction characteristics of muck, peat, marl, and highly organic top soils, these materials were not sampled but were carefully mapped.

All samples were tested by the Joint Highway Research Project, Civil Engineering School, Purdue University. Grain size analysis, Atterburg limits, standard Proctor compaction characteristics, and CBR were determined and the soils classified according to the American Association of State Highway Officials (10).

The engineering soils map was drawn using graphic symbols to delineate parent materials (grouped according to landform and origin). Textural symbols were superimposed on the parent material symbols to indicate relative composition of the parent material soils. The map also carries a set of soil profiles showing the general soil profile of topographic high and low sites in each parent material area. Each profile shows the general range in depth and range in soil textures (ISHC soil textures) of each soil horizon.

DESCRIPTION OF AREA

General

Allen County is located near the northeast corner of Indiana on the Indiana-Ohio State line (Fig. 1). It is the largest county in the State with a length of 28 miles, a width of 24 miles and a total area of 672 square miles.

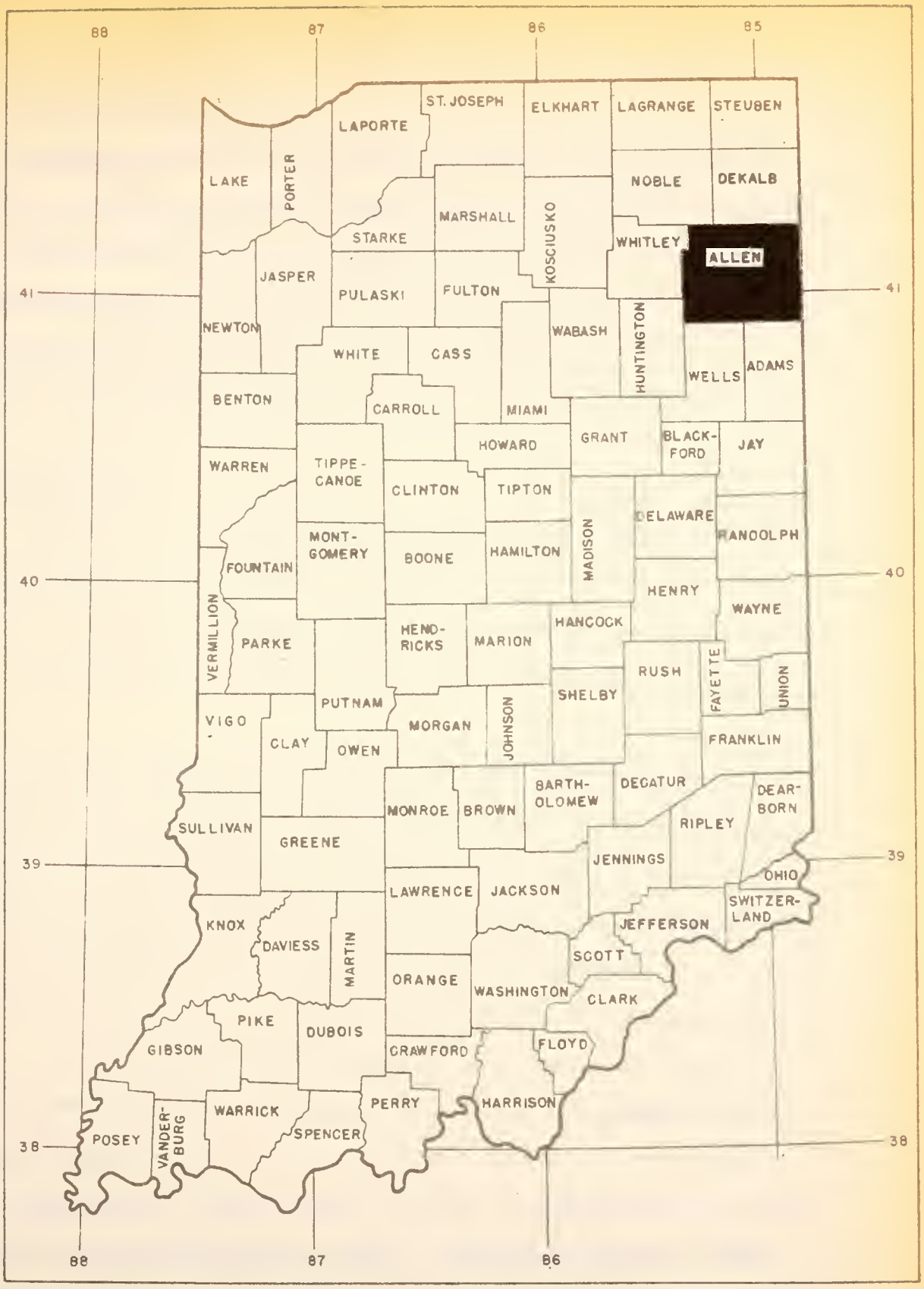


FIG. 1. LOCATION MAP OF ALLEN COUNTY

At the last census, 1960, the total county population was 232,196. At that time about 72 percent of the population was classified as urban and 28 percent as rural (12).

Fort Wayne, the county seat, is located near the center of the county. In 1960 the population of Fort Wayne was reported to be 161,776 (13). There is much diversified industry in and around the city which accounts for stable employment and the relatively large urban population.

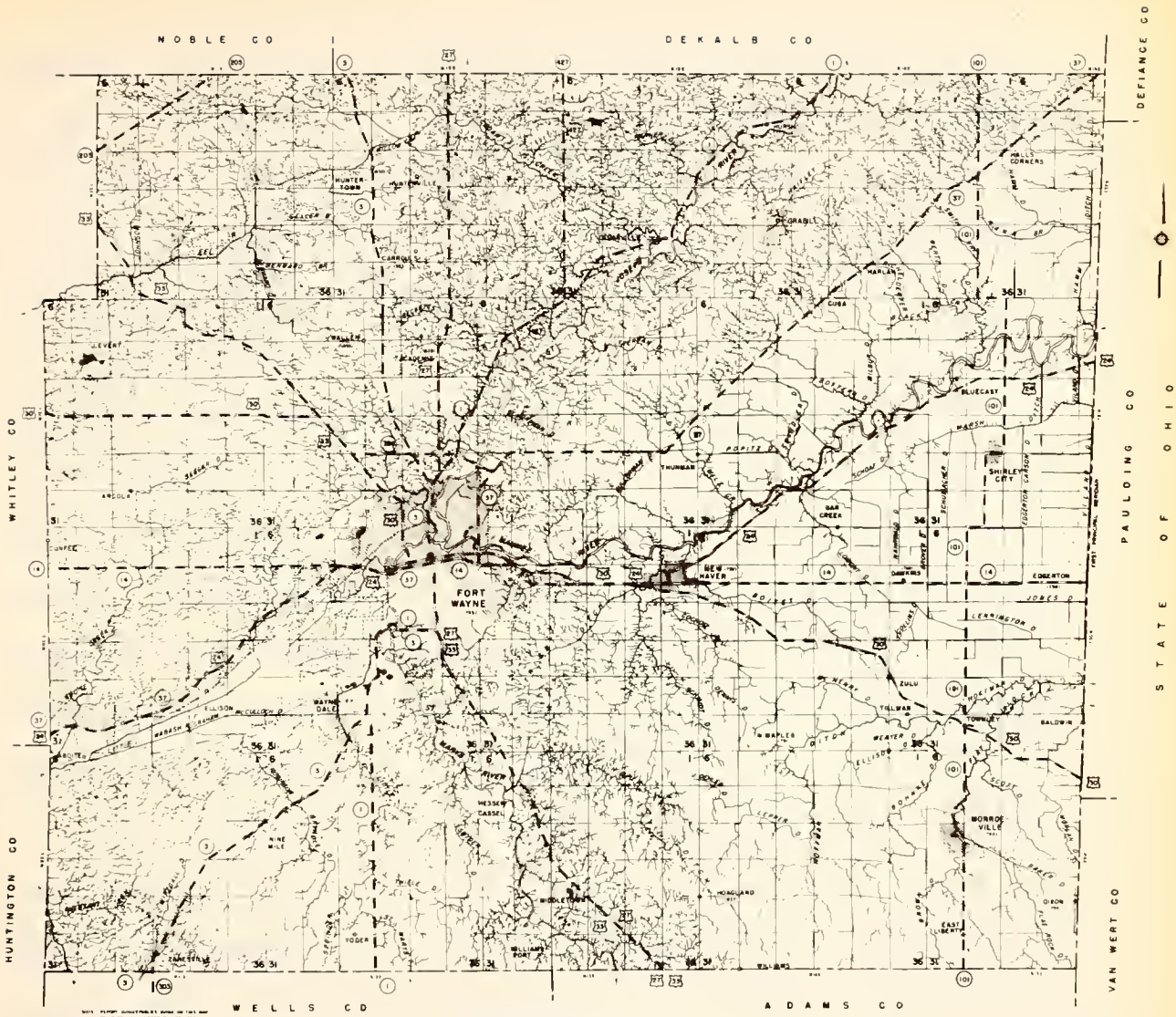
Half the county acreage is used for farming and the three most important crops are corn, soybeans and wheat.

Drainage Features

A Continental Divide between the North Atlantic Ocean and the Gulf of Mexico passes through Allen County several miles west of Fort Wayne (Figures 2 and 3). The western quarter of the county lies in the Wabash River watershed and the eastern three quarters in the Lake Erie watershed.

The principal river in Allen County is the Maumee River which flows easterly out of Fort Wayne to Lake Erie. The two main tributaries of the Maumee are the southwestward flowing St. Joseph River and the northwestward flowing St. Mary's River. The tributaries join in the northern part of Fort Wayne and their combined flow forms the Maumee River. The Maumee River flows across a gently sloping lacustrine plain and, therefore, is a relatively slow and sluggish stream. The Maumee River also collects water from many man-made drainage ditches that drain the large lacustrine plain.

Cedar Creek and tributaries in the north-central part of the county drain a large area within the county. Cedar Creek transects a ridge moraine and joins the St. Joseph River at Cedarville. Flat Rock Creek and Hoffman Creek (West Flat Rock Creek) and their tributaries drain



DRAINAGE MAP

ALLEN COUNTY

INDIANA

PREPARED FROM

1938 AAA AERIAL PHOTOGRAPHS

BY

JOINT HIGHWAY RESEARCH PROJECT

AT

PURDUE UNIVERSITY

1950

FIG. 2

the southern part of the lacustrine plain and much of the adjacent ground moraine before crossing into Ohio.

The western quarter of the county is drained by the Little Wabash River and the Eel River. Eight Mile and Aboite Creeks are tribuaries of the Little Wabash River. Eel River and upper Cedar Creek are underfit streams in the Eel River sluiceway in the northwest corner of the county. The glacial sluiceway extends from Waterloo, in Dekalb County, to the Wabash River at Logansport in Cass County.

The dense drainage patterns, though haphazard in places, generally outline the ridge moraine areas of the county (Fig.2) (7). Crests of ridge moraines frequently define watershed divides within the county. Drainage in the morainic areas is best developed near the principal streams. Drainage in the old glacial sluiceways, described in the following pages, is not developed and the water tables are high. In the ground moraine areas, drainage patterns are more open. In the lacustrine plain, natural drainage has developed the least.

Compared to the counties to the north, kettle lakes are not abundant. They are found in the northwestern half of the county. White Lake and Lake Everett are the largest. A dam on the St. Joseph River, at Cedarville, has produced a man-made lake about three miles long in the river valley.

Climate

The climate of Allen County is continental, temperate and humid. The generally warm humid summers and moderately cold winters are characterized by frequent sudden changes of temperature. The wide variations occuring within a season are indicated by the absolute minimum and absolute maximum temperatures listed in Table I (1).

TABLE I

Normal Monthly, Seasonal, and Annual Temperature and

Precipitation at Fort Wayne, Allen County, Indiana

(Elevation 791)*

Month	Temperature			Precipitation		
	Mean of	Absolute Maximum of	Absolute Minimum of	Mean in.	Total for the Driest Year inches	Total for the Wettest Year inches
Jan.	34.7	69	- 8	2.48	3.10	9.72
Feb.	27.4	69	-19	2.01	2.34	4.43
Mar.	38.5	86	- 9	3.10	1.79	3.19
April	49.1	90	16	3.19	1.28	4.88
May	60.2	99	27	3.58	5.06	1.21
June	69.4	102	36	3.62	2.13	5.58
July	73.9	106	38	3.48	2.06	3.34
Aug.	71.9	102	41	3.00	1.52	4.01
Sept.	65.1	100	30	2.91	1.45	5.23
Oct.	53.7	91	20	2.71	2.22	2.41
Nov.	39.6	79	- 1	2.45	1.03	5.28
Dec.	28.8	65	-17	2.22	.42	2.50
Annual	51.0	106	-19	34.75	24.40 (in 1962)	51.78 (in 1950)

*The elevation of the station has been changed throughout the years from 775 feet (till Oct 1911) to 856 feet then 857 feet, then 777 feet, then 824 feet, then 799 feet, then 801 feet and then to the present 791 feet since Sept. 1961. Compiled from the "Climatological Data of Indiana" on a 66-year record through 1962.

From climatological data covering a 66 year period through 1962, it was determined that the mean annual temperature is 51.0 degrees. The recorded highest temperature was 106, and the lowest was minus 19. The average annual rainfall is 34.75 inches with the wettest year, 1950, having 51.78 inches and driest year, 1962, having 24.40 inches.

Physiography

Allen County lies in the Central Lowlands province of the United States (2). The northern half of the county is in the Eastern Lake section and the southern half is in the Till Plains section.

With respect to Indiana's physiographic divisions, the northern part of the county lies in the Northern Moraine and Lake region and the southern part lies in the Tipton Till Plain (6). The Northern Moraine and Lake region is subdivided into the Steuben Morainal Lake section and the Maumee Lacustrine section.

The most recent modification of the Tipton Till Plain boundaries in Allen County traces the northern boundary along the northern edge of valley train of Eel River to Cedar Creek, along Cedar Creek to the St. Joseph River, and then south along this river to the Fort Wayne spillway (15). "The Salamonie, Wabash and Fort Wayne moraines below this boundary are considered part of the Tipton Till Plain. These moraines are physiographically related more to the Tipton Till Plain than the rugged morainal region to the north" (3).

Topography

The topography of Allen County can best be described with the physiographic sketch (Fig. 3,-note river elevations) and the topographic map (Fig. 4).

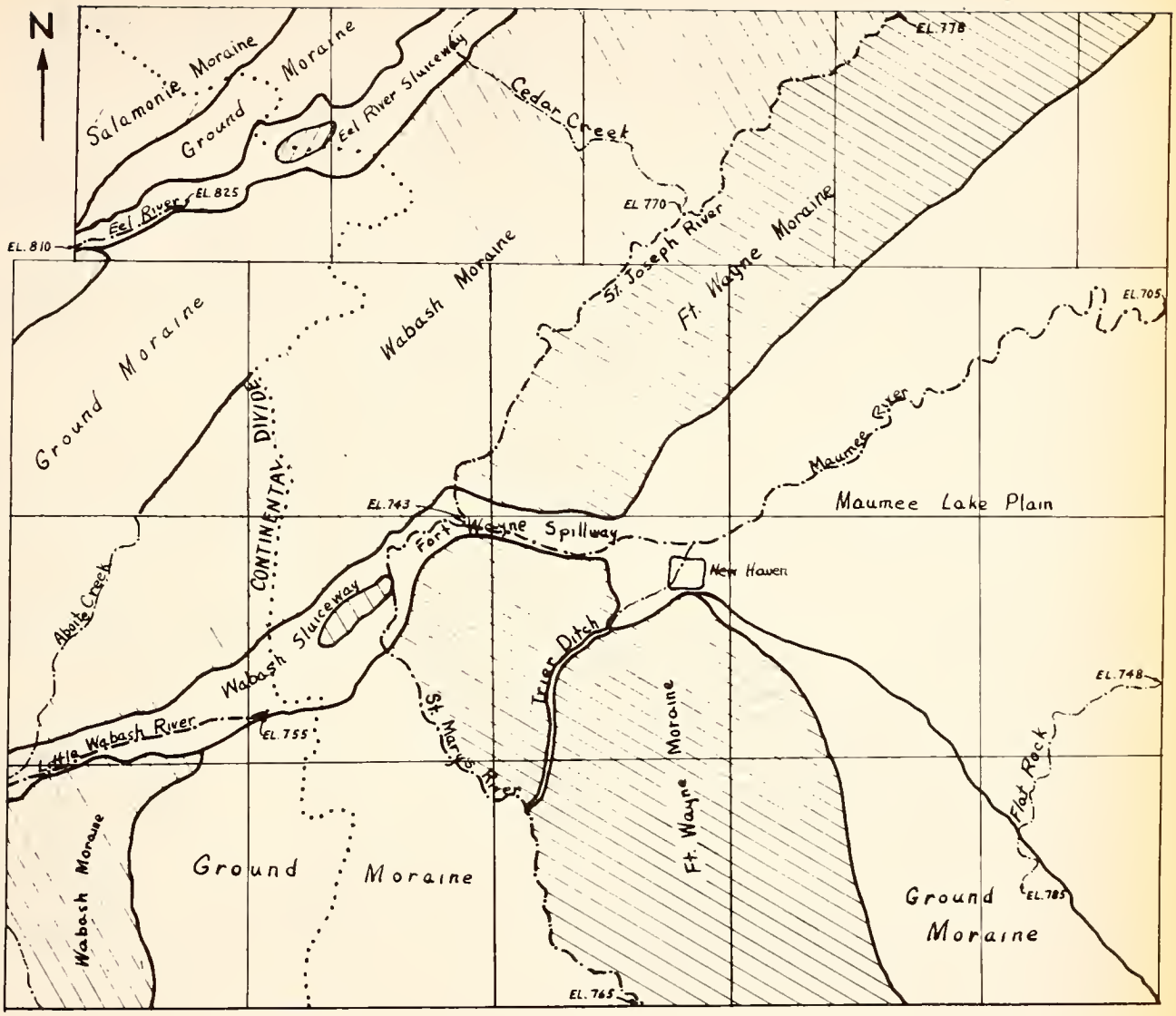
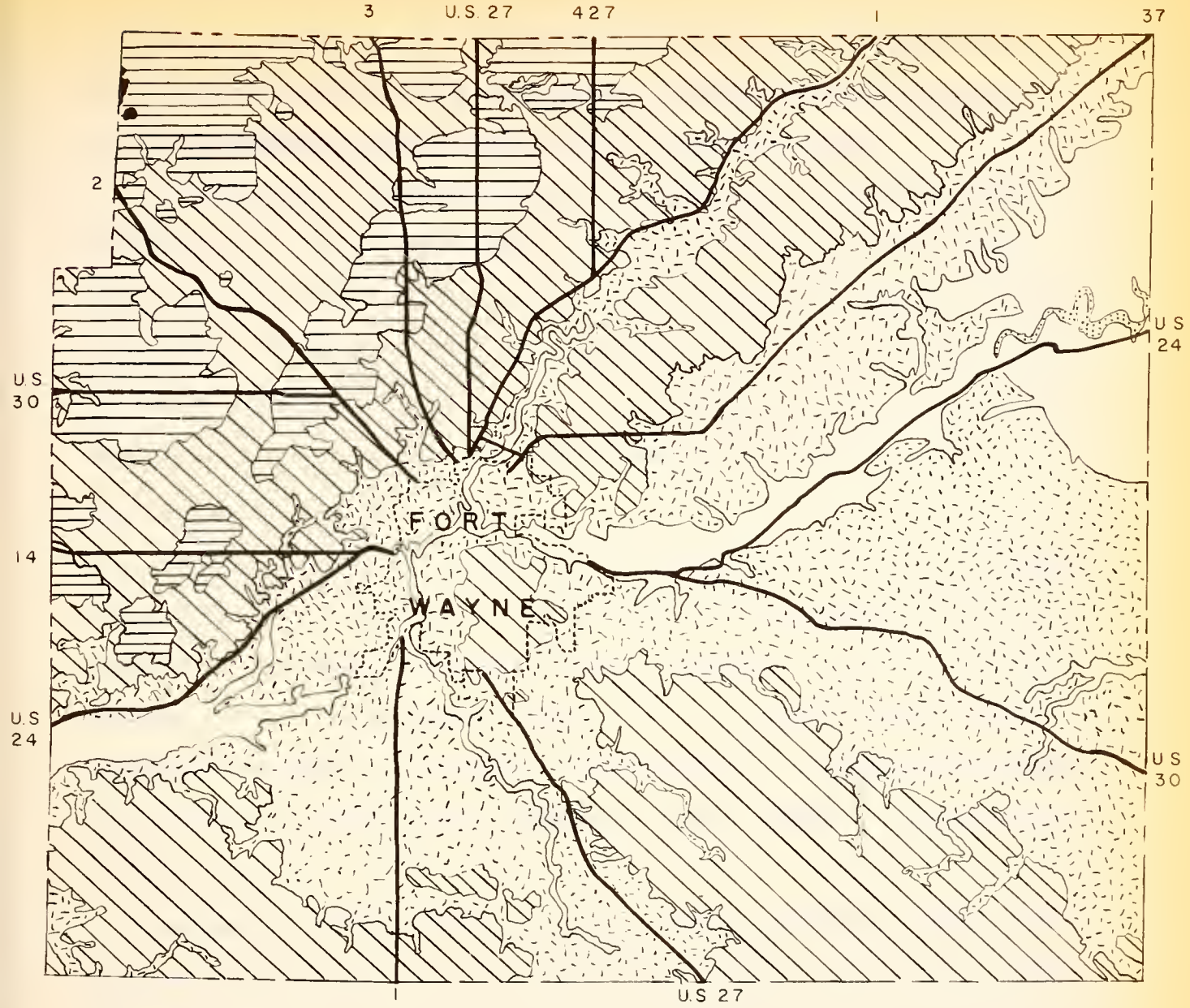


FIG. 3: PHYSIOGRAPHIC SKETCH OF ALLEN CO.



KEY

FROM 900 UP	FROM 750 TO 800
FROM 850 TO 900	FROM 700 TO 750
FROM 800 TO 850	FROM 700 DOWN.

FIG. 4: TOPOGRAPHIC MAP OF ALLEN CO.

(CONTOUR INTERVAL 50')

Essentially all surfaces within the county lie between elevations of 700 feet and 900 feet. The low, of 700 feet, is at the intersection of the Maumee River and the Ohio State Line. The high, of about 900 feet, is in the northwest corner of the county on a morainic ridge.

A large, flat, triangular-shaped lacustrine plain is located on the eastern side of the county between elevations of about 750 feet and 800 feet. The lacustrine plain is crossed by the Maumee River with an alluvial plain some 15 to 60 feet below the lacustrine plain. On the northeast and southeast edges of the lacustrine plain are remnants of small beach ridges. The beach ridges may range up to several hundred feet wide and have a maximum relief of 15 to 20 feet.

There are three beach ridges each at a different elevation. The highest beach ridge, at an elevation of 785 feet, is the most pronounced and best preserved. The intermediate and low ridges, or strand lines, lie at elevations of 775 and 765 feet respectively (3). In the north, the three beach ridges abut against the Fort Wayne ridge moraine in a straight and relatively narrow zone. The southern beach ridges are spread through a zone up to 3 or 4 miles wide.

The ground moraine behind the southern beach ridge grades slowly, into very low rolling hills of the Fort Wayne ridge moraine. To the west of this is the St. Mary's River alluvial plain about ½ mile wide. On to the west there is more ground moraine and ridge moraine as indicated on Figures 2 and 3. Relief of the southern half of the county is very subdued and nearly all surface elevations are contained between 750 feet and 850 feet. To

the west of the Fort Wayne ridge moraine, in the northern half of the of the county, is the St. Joseph River valley ½ to 1 mile wide including its floodplain and well developed terraces and some sand dunes. The river and Cedarville Creek, which transects the Wabash moraine, and also tributaries of these streams, have cut the deepest entrenchments in the county. Relief along Cedar Creek, through the Wabash moraine, ranges from 60 to 80 feet.

As shown in Figures 3 and 4, northwest of the Wabash moraine is low relief associated with ground moraines and the Eel River sluiceway. In the northwest corner of the county rolling relief of the Salamonie moraine is encountered. The sluiceway and ground moraine are primarily between elevations of 800 feet and 850 feet. Maximum elevations of around 900 feet are found at several places on the Salamonie moraine.

Geology

The glacial drift cover in Allen County ranges from about 40 feet (at one limestone quarry) to as much as 300 feet (14). The last ice to across the area was the Erie Lobe which retreated about 12,000 years ago at the end of the Cary substage of the Wisconsin Age of glaciation. The Erie Lobe, advancing primarily over glacial drift, shale and limestone formations, deposited unconsolidated materials that are predominantly clayey in all the upland areas.

As the Erie Lobe melted back and its front periodically hesitated, recessional ridge moraines formed (Figure 5). The first to form in Allen County was the Salamonie moraine in the northwest. Later, the Wabash and Fort Wayne moraines formed farther to the east.

FIG. 5 GLACIAL MAP OF INDIANA

Melt water, trapped between the Fort Wayne moraine and the retreating ice front, formed Lake Maumee I at an elevation of 790 feet. Later Lake Maumee II formed at an elevation of 765 feet. Lake Maumee III then rose above II and formed at elevation 775 feet (3). Thus the lower beach ridge, at elevation 765 feet, was somewhat obsecured.

The lake water overflowed through low saddles in the Fort Wayne moraine. The combined overflow waters from Trier Ditch, the Fort Wayne spillway, the St. Joseph River and the St. Mary's River produced the Maumee Torrent that cut the Wabash sluiceway through the Wabash ridge moraine and adjacent ground moraine (3).

As Lake Maumee receded the combined flow of the St. Joseph and St. Mary's River formed the Maumee River in the floor of the old lake. At first the Maumee River was short and it formed a delta consisting primarily of fine sand and silts in the present location of New Haven. A zone up to 2 miles wide, also of poorly stratified fine sands and silts, developed below the beach ridges of the northern shoreline.

Streams have cut 10 to 25 feet into the glacial deposits. Stream terrace development is strong along the St. Joseph River and many gravel pits are found along the river. Terrace development along the St. Mary's River and the Maumee River was slight and gravel pits are rare. Sand dunes have developed in the river valleys and in the old glacial sluiceways. In the depressions of the old sluiceways muck and peat deposits formed.

The northern half of the county is underlain by bedrock of Devonian age and the southern half by Silurian rocks (8). The upper part part of the Devonian is mainly black shale and the lower part mainly limestone and dolomite. The Silurian is also mainly limestone and dolo-

mite. Bedrock is essentially flat lying but the regional dip may range up to several degrees to the northeast. The rock is on an arm of the Cincinnati Arch and dips into the Michigan Basin.

The bedrock of Allen County, 40 to 300 feet below glacial drift, is rarely encountered in ordinary construction operations. Many of the underlying carbonate rocks make excellent concrete aggregate, base materials, road metal, agricultural lime and cement limestone. Many of the strata consist of dense, hard, limestones, dolomitic limestones, and dolomites. Some of these rocks, however, are so argillaceous (clayey), shaly or cherty that they can not meet the requirements or specifications for certain of the specific uses named.

There are presently three limestone quarries operating in Allen County. The older one, just to the southwest of Fort Wayne in the Little Wabash River Valley, began as a gravel pit. After removal of 35 feet of gravel, 8 feet of clayey till and 7 feet of sand and gravel, the quarrying operation penetrated well over 100 feet into the underlying limestones and dolomites. At a second quarry site, 15 miles east of Fort Wayne on SR 14 and on the Maumee Lake plain, it was necessary to remove 43 feet of clayey till to expose the carbonate strata. Recently a third quarry into bedrock has opened on the Maumee River about 3 miles west of Woodburn.

LAND FORMS
AND
ENGINEERING SOIL AREAS

The soils of Allen County can be divided into four major groups: (1) glacial deposits (2) fluvial deposits (3) aolian deposits and (4) miscellaneous deposits. In the discussion below each of the major groups is further subdivided into landform-parent material groups. These groups are subdivided into soil textural groups.

GLACIAL DEPOSITED MATERIALS

The landforms of glacial deposited materials in Allen County include ridge moraines and ground moraines. The ridge and ground moraines, together constitute about two thirds of the total area of the county.

1. Ridge Moraines

From west to east, the ridge moraines of Allen County are Salamonie, Wabash and Fort Wayne. These moraines occupy nearly one half the area of the county. Essentially all the parent materials of all the ridge moraines are clayey in texture, however, a few small areas have been delineated for their silty textured soils.

a. Ridge Moraine - Clayey Texture

The Salamonie moraine crosses the northwest corner of Allen County. The Wabash moraine forms an arc across the western half of the county. It shows a general northeast-southwest trend. The Fort Wayne moraine is a significant arc across the central part of the county. It extends to the northeast and to the southeast. In the northern part of the county the Wabash and Fort Wayne moraines are separated by the valley of the St. Joseph River. These moraines have been breached by a sluiceway extending east-west through the city of Fort Wayne.

Local relief differences of about 30 to 50 ft. or more occur in the northern part of these moraines. Local relief is not as great in the southern half of the county - it is only around 20 ft.

The greatest relief difference, of 60 to 80 ft., occurs in the Wabash Moraine around the valley of Cedar Creek.

The soil horizons of these ridge moraines are clayey in texture. The A-horizon, ranging from 6 in. to about 2 ft. may be a clay, a silty clay or a silty clay loam. The B-horizon, ranging down to about 6 ft., is usually a clay, clay loam or silty clay loam.

The ridge moraines were sampled at sites 5, 11 and 13. Site 5 was 2 miles west of Grabill; site 11 - 3 miles east of Cedarville; and site 13 was 2 miles northeast of Hessen Cassel.

The parent materials at these three sites showed a range of: 1-3 percent gravel, 9-17 percent sand, 30 to 34 percent silt and 50-55 percent clay. The parent materials all classified as low to medium plastic clays.

In the southeast part of the county, along Interstate Highway 69, 25 soil borings (numbers 25 through 49 on the engineering soils map) point up the consistent clayey nature of the morainic soils. A tabulation of these ISHC borings is shown in Appendix B. Many of the borings penetrated deeper than 20 ft. and by far the greater majority of borings show plastic clay soils from top to bottom. A very small percentage of the samples classified as silt or silty clay soils and many of these were top soils or soil strata at considerable depths.

Pedologically, the majority of the soils in the ridge moraines are Morley and Blount soils. There are very small areas of Pewamo, St. Clair, Nappanee and Washtenaw.

b. Ridge Moraine - Silty Texture

There are only three very small areas of silty textured ridge moraines in the southern tip of the Salamonie moraine. The soil areas outlined are about one mile north of Lovett. Since the total area is so small, texture is discussed under ground moraines of silty texture.

2. Ground Moraines

There are three major ground moraine areas in the county. One is located in the northwest between the Salamonie and the Wabash moraines; another is in the southcentral between the Wabash and Fort Wayne moraines and the third is in the southeast between the Fort Wayne moraine and the lacustrine plain. Relief is generally less than 20 ft. and the areas are best described as gently undulating plains. In the southern half of the county there is only a slight contrast between the topography of the ground moraine and the ridge moraine.

a. Ground Moraines - Clayey Texture

The ground moraine soils are very similar to the ridge moraine soils. Because of lower relief, and thus slower drainage, the surface soils may exhibit a higher clay content.

Two sites were examined and tested in the ground moraines. Site 4 was located near the southwest corner of Fort Wayne and site 6 was 3 miles northwest of Huntertown.

The parent materials at the two test sites showed a range of: 0-7 percent gravel, 19-29 percent sand, 33-34 percent silt and 31-37 percent clay. The soils classified as low plastic clays.

The ground moraines are primarily Blount and Pewamo soil series with the St. Clair, Nappanee and Washtenaw being secondary.

b. Ground Moraines - Silty Texture

Ground moraines with soils of silty texture are mapped as small isolated areas in the vicinity of Huntertown. Some small areas occur 4 miles southwest of Huntertown. Others extend north into Dekalb County and were sampled there (16).

The surface soils, 9 to 12 in., are silty clay loams and are generally underlain with silty clays to about 2 or 3 ft. The parent materials are glacial tills with a relatively high silt content and generally have textures ranging from silts to low plastic clays.

Pedologically the silty textured moraines in Allen and Dekalb Counties belong to the Miami, Crosby and Brookston soil series.

LACUSTRINE DEPOSITS

The largest single lacustrine deposit was on the floor of old glacial Lake Maumee in the eastern third of the county. Some smaller areas of this large lacustrine plain, near the shorelines and at the mouth of the Maumee River received additional sediments from the uplands consisting of clays, silts and fine sands. Large depressional areas in the major sluiceways and smaller basins, or kettle holes in the moraines, became sites for seasonal and blackwater lakes. Beach ridges are discussed separately.

3. Lacustrine Plains

The lacustrine materials are divided into three textural groups: (1) the clayey materials (2) poorly stratified clays and silts and (3) poorly stratified fine sands and silts.

a. Lacustrine Plains - Clayey Textured

The great lacustrine plain, east of New Haven, is composed of a highly plastic clay. The predominance and uniformity of distribution of the clay is shown by five test sites. Sites 2 and 12 are in the northern

part of the lacustrine plain; sites 1 and 3 are centrally located and site 10 is in the south central area.

The A-, B- and C-horizon soils from each of the five sites were tested and classified. Of the 15 samples classified, 14 classified as medium plastic clays exhibiting elastic properties and one classified as a moderately plastic clay. All soil horizons were found to contain a very high percentage of plastic clays with the B-horizon the greater amount.

Hoytville, Nappanee and Pewamo soil series are the main soils in the major lacustrine plain area.

b. Lacustrine Plains

Certain depressional areas on the lacustrine plain and in the sluiceways were seasonally flooded with waters carrying predominantly clayey materials and lesser amounts of silts and fine sands. The situation produced poorly stratified, generally clayey, lacustrine deposits.

The parent materials, or C-horizon, of these lacustrine deposits, are composed of stratified plastic clays and moderately plastic silty clays with lenses or seams of silt and fine sand up to 3 or 4 in. thick. The A-horizon ranges from 6 to 24 in. in depth. The color ranges from dark brown to black and frequently has a high organic content. The A-horizon soils are usually clays, clay loams or silty clays. The B-horizon is a more plastic clay and may extend to a depth of about 6 ft.

The largest area of this type is about six square miles and lies on the lacustrine plain just to the north of New Haven. There are other smaller deposits on all sides of the New Haven area. Depressional areas in the major sluiceways, namely, the Little Wabash River valley, Trier Ditch, and the lower part of the St. Mary's River became slackwater areas

in which the poorly stratified clayey soils also accumulated. In the west-central and northwestern corner of the county there are several fairly large lacustrine deposits that formed in basins or kettle holes primarily in the ground moraine areas.

The lacustrine soils along the southern edge of the Little Wabash River valley were frequently sampled and tested along route I-69. Test sites, 52 to 64, have been located on the engineering soils map and the test results shown in Appendix B. A deep boring at site 55 indicated: 0-2 ft. clay loam; 4-6 ft. clay, and 6 to 20 ft. sand. Most of the other borings in the area went only to 6 ft. and it is noted that these occasionally terminated in a sandy loam and once in sand. This part of the lake bed deposit is probably underlain by granular outwash.

Soil textures in deep borings in the sluiceways may be highly variable for a number of reasons: (1) intermingling of parent materials as seen on the surface undoubtedly also occurs vertically and (2) in sampling and testing stratified parent soils there will be mixing of different materials in different strata so that a large number of samples could show a large variation of textures.

Pedologically the soils of the stratified lacustrine plain soils are primarily the Lenawee and Montgomery. The Aboite and Bono soils are secondary in extent.

c. Lacustrine Plains - Sandy and Silty Texture

Along the northeastern shore line of old glacial Lake Maumee outwash of silts and fine sands from the Fort Wayne ridge moraine and beach ridges were laid down and somewhat stratified in the shallow lake waters. Most of the smaller clay particles drifted farther out into the lake.

However, some clay and some fine gravel were occasionally deposited with the stratified silts and fine sands.

As the lake waters retreated eastward, flow from the St. Joseph River and St. Mary's River formed the Maumee River. The eastward flowing Maumee then deposited silts and sands, in the present area of New Haven, possibly in a deltaic-type of deposit in the lacustrine plain.

The parent material is about 2 to 4 ft. below the surface. Texture ranges from stratified silts and fine sands to sandy loams and in some areas may contain some gravel and clay mixed throughout the profile (9). The A- and B-horizons are mainly clays, silty clays and silty clay loams so that the line between these materials and other lacustrine materials is almost arbitrary. The soils belong to the Homer, loamy substratum, and the Rensselaer series.

4. Beach Ridges - Sand and Gravel Texture

The three sets of beach ridges around the lacustrine plain of old glacial Lake Maumee have been discussed in previous pages as to location, altitude, origin and topography.

The beach ridges are composed of littoral drift of sand, gravel, and, in places till. The high beach, along the Fort Wayne moraine, becomes less sandy to the north. It is essentially a gravel ridge from Harlan to the State line. The southern part of the beach ridge has been partially destroyed by construction. Leverett (3) reported that the upper beach ridge curved into Trier Ditch a mile west of New Haven. Near New Haven School, it is composed of sand and its altitude is 785 ft.

Between the beaches on the south, are short discontinuous sand ridges. These may represent offshore bars or immature beaches formed when the lake level fluctuated (3). These latter sand ridges were too small, shallow

[illegible] which [illegible] [illegible] [illegible]

and insignificant to map on the engineering soils map but should be anticipated in field work.

The parent material ranges from a poorly graded, stratified sand and gravel to a sandy loam. The gravel is fine and may contain many soft weathered shale particles. In some places there is a considerable amount of silt and clay mixed with the sand and gravel--the amount of fines is extremely variable. Depth to the parent material is also extremely variable from place to place but most frequently it is between 1 and 6 ft. In some areas silty clay, or clay till, or lacustrine materials occur at a depth of 4 to 6 ft.

Dominant surface soil types are loams and clay loams. The upper B-horizon generally is sandy clay loam or sand clay and the lower B-horizon is more gravelly. Beach ridge soils belong to the Belmore series.

FLUVIAL DEPOSITS

Fairly extensive fluvial deposits occur along the major rivers in Allen County. These water-deposited materials occur in the form of outwash plains, sluiceways, terraces and alluvial plains. Major outwash plains and terraces occur along the Maumee, St. Mary's and St. Joseph Rivers within the environs of the City of Fort Wayne. Sluiceways and terraces occur along the Eel and Little Wabash Rivers. Extensive terraces exist along the St. Joseph River throughout its length in Allen County. All the rivers exhibit alluvial plains, or flood plains, adjacent to the stream. These landform-parent material areas are discussed in the following sections.

5. <u>Outwash Plains and Terraces</u>

The granular outwash plains and river terraces have similar textured materials. The two major textural divisions are (1) gravelly and sandy soils and (2) sandy and silty soils. The gravelly and sandy soils have about 25 to 50 percent gravel, 50-70 sand and 0-10 percent silt and clay.

Thus the most gravelly parent material in the county most frequently classifies as a gravelly sand. It is relatively rare that the percent of gravel goes over 50 percent in which case the material classifies as a sandy gravel.

The gravel soils belong primarily to Martinsville, gravelly substratum, the Fox and the Westland soil series.

Most of the sandy and silty textured outwash has a composition range as follows: 0-5 percent gravel, 45-60 percent sand, and 30-40 percent silt and clay. The majority of the content of fine grain soils is usually silt. Thus in general, the parent material usually classifies as a sandy loam but, due to stratification, textural classification can vary widely.

These soils belong primarily to the soil series Martinsville and Ransselaer.

a. Outwash Plains - Gravelly and Sandy Texture

The more gravelly outwash in the Eel River sluiceway lies to the north of Huntertown. Some of the more gravelly outwash also lies in the west end of the sluiceway where sample site 7 was located. At site 7, the parent material, below 3½ ft., contains 22 percent gravel, 73 percent sand and 5 percent silt and clay and classifies as a gravelly sand. The B-horizon was found to be a sandy clay loam and the A-horizon, a loam.

The more gravelly part of the Little Wabash River valley lies in, and to the southwest, of Fort Wayne. Sample site 9 in this area shows that the C-horizon, below 4½ ft., contains 31 percent gravel, 61 percent sand, 4 percent silt and 4 percent clay and is also a gravelly sand. Both the A- and B-horizons are sandy loams.

[illegible] [illegible] [illegible] [

b. Outwash Plains - Sandy and Silty Texture

The outwash plains around Huntertown and the other smaller outwash plains on Eel River, to the southwest, are predominantly sandy and silty. Sample site 14, 4 miles southwest of Huntertown, has a parent material below 4½ ft. composed of 39 percent sand, 43 percent silt, and 18 percent clay--it is a loamy soil. The B-horizon was found to be a clay and the A-horizon a silty loam. Visual observations of exposures around Huntertown show the outwash to be considerably more sandy and less silty.

A large sandy and silty outwash plain extends through the heart of Fort Wayne and out beyond the southwest corner and the east central side of the city. Borings for a bridge on U.S. 27 over the St. Mary's River, in Fort Wayne, show several feet of silty and sandy loams, with some organic material over 29 ft. of fine to coarse sand with traces of silt and gravel.

There are a number of smaller sandy and silty outwash plains in the Little Wabash River valley to the southwest. Two I-69 borings, numbered 50 and 51 in small outwash areas, show: boring 50 - 10 ft. of clay loam and clay over 6 ft. of sand; boring 51 - 8 ft. of sandy loams over 12 ft. of sand (see detailed data, Appendix B). Other borings in the lacustrine materials occasionally show sand at 5 or 6 ft. The entire valley is most likely underlain with granular soils as evidenced by streams terminating at the valley edges.

c. Terraces - Gravelly and Sandy Textures

Gravelly textured terraces are most abundant along the St. Joseph River. The larger ones are located along the upper part of the river, on the west side, between the county line and Cedar Creek. A considerable number of the terraces are being developed as residential sites.

There are several gravelly textured terraces along St. Mary's River and along Eight Mile Creek in the extreme southwest corner of the county. Two borings for I-69, borings numbered 18 and 19 on the engineering soils map in a terrace of Eight Mile Creek, encountered the following: boring 18 - 4 ft. of clay over 2 ft. of loam; boring 19 - 2 ft. of clay over 6 ft. of sandy clay loam over 2 ft. of sandy loam.

d. Terraces - Sandy and Silty Texture

Sandy and silty textured terraces are associated with all the gravelly textured terraces on the major rivers and creeks. The texture and depth to parent material varies considerably. The depth may range from 2 to 7 ft. and the texture from predominantly sandy to predominantly silty and clayey.

Site number 16, on a terrace on the St. Mary's River at the junction of Trier Ditch, penetrated 5½ feet but did not encounter the C-horizon. The lower part of the B-horizon, contained: 6 percent gravel, 47 percent sand, 27 percent silt, 20 percent clay and classified as sandy clay loam.

A terrace was sampled on the Maumee River between Fort Wayne and New Haven. It was site number 15 and the material, below 2½ feet, contained no gravel, 9 percent sand, 56 percent silt, 35 percent clay and classified as a silty clay. The stratified parent material was not encountered.

As all the terraces along the Maumee River were deposited in recent times by a sluggish stream, the terrace materials may be anticipated to be about as fine as those described at site 15.

e. Alluvial Plains

Practically all rivers and minor drainage channels possess recent alluvial plains; however only those of considerable size are shown on the engineering soils map because of scale limitations. The alluvial plains

are also known as flood plains so the designated areas on the map may be subject to seasonal flooding.

The largest alluvial plain in the county is along the sluggish Maumee River. The St. Mary's and St. Joseph Rivers and Cedar Creek also have fair size alluvial plains. Aboite Creek has dumped a relatively large amount of alluvium on the western edge of the Little Wabash River valley. Eight Mile Creek in the southwest, and Flat Rock Creek in the southeast, also have alluvial plains of notable size.

The textures of alluvial deposits vary greatly from place to place. Top soil varies mainly from loam to silt loam. On higher plains, where flooding is less frequent, subsoil varies from silt loam to silty clay loam. In areas subject to frequent flooding, the material may range from loam, to sandy loam, to silt loam to silty clay loam. Stratification may be observed occasionally. Along most of the streams, with a main exception of the Maumee River, a sand or gravelly sand material may be found below a depth of 5 ft. or more.

There were four test sites in alluvium along I-69 at Eight Mile Creek. These were sites numbered 17, 22, 23 and 24 and are described in Appendix B. The deepest boring, site 23, showed 0-2 ft. clay, 2-10 ft. sand and 10-12 ft. clay.

The Eel soil series is by far the predominating soil with the Genesee second in areal extent.

EOLIAN DEPOSITS

Eolian or wind deposited materials as mappable units occur as dunes in Allen County.

6. Sand Dunes

The largest concentration of sand dunes are found around New Haven on sand and silty outwash plains and some lacustrine plains. There are also a good number of dunes scattered through the entire central part of the Little Wabash River valley. There are numerous dunes along the St. Joseph River and most of these lie on the upper part of the southern valley walls. Around Huntertown, on the large outwash plain, there are a few small scattered dunes.

The material is a fine, uniform sand usually 5 to 10 or more feet deep but on some of the lacustrine deposits it may be 3½ to 5½ ft. and underlain by clay.

Pedologically soils of the sand dunes belong primarily to the Chelsea and Plainfield series. The Plainfield series have the clayey substratum.

MISCELLANEOUS DEPOSITS

Several areas of organic soils have developed in kettles, basins and low, poorly drained areas. These are grouped under miscellaneous deposits and discussed as follows.

7. Muck and Peat Basins

The muck and peat in Allen County developed from reeds, sedges, woody brush and timber. Peat developed when oxidation of the vegetation was very slow or nearly ineffective. Muck developed with complete oxidation and decomposition of the organic matter. Occasionally about 1 to 3 ft. of marl is found with the muck and peat. Marl is a soft, earthy material composed principally of an amorphous form of calcium carbonate. All three materials are unstable and must be removed from essentially all construction sites or specially treated.

All the significant muck and peat deposits are found in the northwestern half of the county. It is reported that they cover 2 percent of the total county area (9). The two main concentrations are in the old glacial sluiceway going through Huntertown and in the sluiceway west of Fort Wayne. The Wabash and Salamonie ridge moraines and the intervening ground moraines in the northwest part of the county also contain numerous muck and peat deposits.

Most of the muck and peat deposits in Allen County range from 1 to 3½ ft. but it is possible for some of them to be over 30 or 40 ft. deep. Since the horizontal and vertical extent of the organic deposits varies greatly, each individual deposit must be carefully probed in the field before design is started.

In the Little Wabash River valley, route I-69 crosses a muck area of substantial size. At test sites 68, 69, 70, 71 and 73 most of the organic material was only about 1 ft. deep. The attached soils map shows the test site locations and field logs are provided in Appendix B. At site 72 muck and "marl-like" material were found to a depth of 4 ft. Special field investigations, several hundred feet north of site 73, showed muck and marl to a maximum depth of 13 ft. The water table was near the surface over most of the deposit.

Pedologically the muck and peat deposit materials belong to the Carlisle, Tawas, Linwood, Willette and Wallkill soil series.

8. <u>Highly Organic Depressions</u>

Depressed areas, where internal drainage is somewhat retarded by high ground water, frequently give rise to the accumulation of considerable amounts of organic top soil. As would be expected, most of the highly organic top soil areas are adjacent to the muck and peat areas. The highly organic top soil areas should be field checked to determine the amount of material to be removed and to determine whether or not the material grades into a muck pocket.

Pedologically these soils belong mainly to the Pewamo mucky silty clay loams and to the Bono mucky silty clays and the Lenawee mucky silty clay loams.

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Site No.	Horizon	Depth in Ft.	Gravel Greater Than #4 %	Molded Moisture Content for CBR Test	Unified Classification	AASHO Classification
1	A_p	0-1/2	0	20.7	OL	A-7-5(14)
	B_{21g}	1-2 1/12	0	21.5	CH	A-7-6(16)
	C	3 1/3 +	0	19.0	CL	A-7-6(16)
2	A_p	0-7/12	0	22.6	CH	A-7-6(18)
	B_{22g}	1 5/6-2 11/12	0	21.4	CH	A-7-6(20)
	C	3 2/3 +	1	17.4	CL	A-7-6(15)
3	A_p	0-7/12	0	21.3	CH	A-7-6(19)
	B_{21g}	1 1/4-2 1/12	0	20.6	CH	A-7-6(19)
	C	3 5/12 +	0	20.0	CL	A-7-6(17)
4	A_1	0-5/6	0	18.3	OL	A-4(8)
	B_2	1 1/3-2 1/12	0	22.6	CL	A-7-6(13)
	C_1	2 5/12 +	0	17.0	CL	A-6(9)
5	A_1	0-1/2	0	23.8	OL	A-5(9)
	B_2	1 1/12-2 1/6	1	20.9	CH	A-7-6(19)
	C_1	2 7/12 +	0	1[illegible].5	CL	A-7-6(14)
6	A_p	0-7/12	0	13.4	CL-ML	A-4(8)
	B_{22}	1 5/12-2 5/12	0	20.8	CL	A-6(12)
	C	2 5/6 +	3	14.7	CL	A-6(8)
7	A_1	0-2/3	2	13.6	OL	A-4(3)
	B_{21}	1 1/3-2 7/12	7	13.7	SM	A-2-4(0)
	C	3 5/6 +	8	10.1	SW	A-1-b(0)
8	A_1	0-2/3	0	17.8	CL	A-4(7)
	B_{21}	1 3/4-3 1/2	0	13.3	SC	A-4(2)
	C	5 2/3 +	18	9.1	SP	A-1-b(0)

Site No.	Horizon	Depth in ft.	Grain Size Distribution: Gravel Greater Than #4 %	Fine Gravel #4-#10 %	Coarse Sand #10-#40 %	Fine Sand #40-#200 %	Silt #200-0.005 mm %	Clay Less than 0.005 mm %	Liquid Limit %	Plastic Index %	Standard Laboratory Compaction (AASHO T99): O.M.C. %	Max. Dry Weight pcf	CBR 35 lb. Surcharge	Molded Moisture Content for CBR Test	Unified Classification	AASHO Classification
1	A_p	0-1/2	0	0	2	11	37	50	50	19	21	104	9	20.7	OL	A-7-5(14)
	B_{21g}	1-2 1/12	0	0	3	9	33	55	51	24	22	100	7	21.5	CH	A-7-6(16)
	C	3 1/3 +	0	0	3	11	30	56	45	27	20	106	7	19.0	CL	A-7-6(16)
2	A_p	0-7/12	0	0	2	10	34	54	54	28	23	99	7	22.6	CH	A-7-6(18)
	B_{22g}	1 5/6-2 11/12	0	3	3	7	29	58	59	38	22	102	6	21.4	CH	A-7-6(20)
	C	3 2/3 +	1	4	4	10	31	50	44	25	18	106	2	17.4	CL	A-7-6(15)
3	A_p	0-7/12	0	0	3	7	34	56	55	36	20	103	6	21.3	CH	A-7-6(19)
	B_{21g}	1 1/4-2 1/12	0	0	3	11	28	58	53	33	19	103	7	20.6	CH	A-7-6(19)
	C	3 5/12 +	0	0	3	10	31	56	49	29	20	105	6	20.0	CL	A-7-6(17)
4	A_1	0-5/6	0	0	3	12	62	23	32	7	18	106	4	18.3	OL	A-4(8)
	B_2	1 1/3-2 1/12	0	0	3	20	23	54	46	19	21	101	5	22.6	CL	A-7-6(13)
	C_1	2 5/12 +	0	0	6	13	34	47	33	13	17	112	6	17.0	CL	A-6(9)
5	A_1	0-1/2	0	2	5	15	58	20	47	9	24	93	5	23.8	OL	A-5(9)
	B_2	1 1/12-2 1/6	1	1	3	12	25	58	55	31	21	104	6	20.9	CH	A-7-6(19)
	C_1	2 7/12 +	0	2	2	7	34	55	44	24	16	108	5	17.5	CL	A-7-6(14)
6	A_p	0-7/12	0	0	4	21	44	31	28	6	14	108	14	13.4	CL-ML	A-4(8)
	B_{22}	1 5/12-2 5/12	0	0	2	11	32	55	40	19	20	105	5	20.8	CL	A-6(12)
	C	2 5/6 +	3	4	8	21	33	31	29	15	14	120	3	14.7	CL	A-6(8)
7	A_1	0-2/3	2	2	7	38	36	15	21	NP	14	111	18	13.6	OL	A-4(3)
	B_{21}	1 1/3-2 7/12	7	1	27	37	8	20	27	10	14	116	5	13.7	SM	A-2-4(0)
	C	3 5/6 +	8	14	52	21	0	5	NP	NP	11	120	42	10.1	SW	A-1-b(0)
8	A_1	0-2/3	0	0	2	29	55	14	30	8	18	103	9	17.8	CL	A-4(7)
	B_{21}	1 3/4-3 1/2	0	0	10	44	25	21	25	9	13	119	3	13.3	SC	A-4(2)
	C	5 2/3 +	18	32	5	42	0	3	NP	NP	12	124	25	9.1	SP	A-1-b(0)

Site No.	Horizon	Depth in Ft.	Gravel Greater Than #4, %	Molded Moisture Content for CBR Test	Unified Classification	AASHO Classification
9	A_1	0-7/12	0	12.8	SM	A-4(2)
	B_{21}	1 1/6-2 5/12	5	12.4	SM	A-2-4(0)
	C	4 1/4 +	12	11.5	SW-SM	A-1-b(0)
10	A_P	0-7/12	0	20.6	CL	A-7-6(13)
	B_{22g}	1-2	0	21.1	CL	A-7-6(15)
	C	3 +	0	20.4	CL	A-7-6(13)
11	A_P	0-7/12	0	21.2	CL	A-7-6(12)
	B_{22g}	11/12-2	0	18.3	CH	A-7-6(18)
	C	2 2/3 +	1	13.3	CL	A-7-6(14)
12	A_P	0-7/12	0	22.5	CL	A-7-6(14)
	B_{2g}	1 1/12-2 1/3	0	20.6	CL	A-7-6(17)
	C	3 1/6 +	0	19.9	CL	A-7-6(14)
13	A_P	0-5/12	0	17.1	CL	A-6(9)
	B_{22}	1 1/6-2	0	21.6	CL	A-7-6(16)
	C	2 +	0	18.8	CL	A-6(12)
14	A_1	0-1/2	0	23.5	OL	A-5(9)
	B_{21}	1 1/2-3 1/6	0	16.8	CL	A-6(10)
	C	4 5/6 +	0	11.7	CL-ML	A-4(5)
15	A_P	0-2/3	0	15.1	CL-ML	A-4(8)
	B_{21}	1-2	0	16.0	CL	A-6(9)
	C	2 5/12 +	0	17.0	CL	A-4(8)
16	A_P	0-2/3	0	15.7	CL	A-4(6)
	B_{21}	1 3/4-3 1/3	0	16.9	CL	A-6(12)
	B_{23}	3 5/6-5 5/12	0	13.4	SC	A-4(2)

Site No.	Horizon	Depth in Ft.	Grain Size Distribution: Gravel Greater Than #4 %	Fine Gravel #4-#10 %	Coarse Sand #10-#40 %	Fine Sand #40-#200 %	Silt #200-0.005 mm %	Clay Less than 0.005 mm %	Liquid Limit %	Plastic Index %	Standard Laboratory Compaction (AASHO T99): O.M.C. %	Max. Dry Weight pcf	CBR 35 lb. Surcharge	Molded Moisture Content for CBR Test	Unified Classification	AASHO Classification
9	A_1	0-7/12	0	2	11	43	30	14	19	NP	12	117	9	12.8	SM	A-4(2)
	B_{21}	1 1/6-2 5/12	5	11	20	39	10	15	21	NP	12	120	8	12.4	SM	A-2-4(0)
	C	4 1/4 +	12	19	38	23	4	4	NP	NP	12	123	11	11.5	SW-SM	A-1-b(0)
10	A_p	0-7/12	0	0	3	8	44	45	44	21	21	103	7	20.6	CL	A-7-6(13)
	B_{22g}	1-2	0	0	2	12	33	53	48	24	20	101	7	21.1	CL	A-7-6(15)
	C	3 +	0	0	6	10	31	53	41	22	20	106	5	20.4	CL	A-7-6(13)
11	A_p	0-7/12	0	0	4	15	41	40	42	19	21	101	5	21.2	CL	A-7-6(12)
	B_{22g}	11/12-2	0	2	3	14	29	52	52	33	18	106	8	18.3	CH	A-7-6(18)
	C	2 2/3 +	1	2	4	13	30	50	42	24	19	108	6	13.3	CL	A-7-6(14)
12	A_p	0-7/12	0	0	4	10	42	44	47	21	22	97	6	22.5	CL	A-7-6(14)
	B_{2g}	1 1/12-2 1/3	0	0	4	12	31	53	48	28	20	103	5	20.6	CL	A-7-6(17)
	C	3 1/6 +	0	0	4	11	32	53	42	24	20	108	6	19.9	CL	A-7-6(14)
13	A_p	0-5/12	0	3	4	15	44	34	31	12	17	107	5	17.1	CL	A-6(9)
	B_{22}	1 1/6-2	0	2	4	12	29	53	49	26	21	104	6	21.6	CL	A-7-6(16)
	C	2 +	0	1	4	11	34	50	39	20	19	108	6	18.8	CL	A-6(12)
14	A_1	0-1/2	0	0	2	18	63	17	43	6	23	91	6	23.5	OL	A-5(9)
	B_{21}	1 1/2-3 1/6	0	0	1	13	50	36	37	16	17	111	4	16.8	CL	A-6(10)
	C	4 5/6 +	0	0	8	31	43	18	19	4	12	121	6	11.7	CL-ML	A-4(5)
15	A_p	0-2/3	0	0	2	25	53	20	28	7	15	110	8	15.1	CL-ML	A-4(8)
	B_{21}	1-2	0	0	1	17	47	35	33	13	17	110	7	16.0	CL	A-6(9)
	C	2 5/12 +	0	0	3	6	56	35	29	9	17	113	3	17.0	CL	A-4(8)
16	A_p	0-2/3	0	0	1	32	43	24	26	8	16	110	4	15.7	CL	A-4(6)
	B_{21}	1 3/4-3 1/3	0	0	2	23	38	37	36	20	17	111	4	16.9	CL	A-6(12)
	B_{23}	3 5/6-5 5/12	0	6	2	45	27	20	23	8	13	119	3	13.4	SC	A-4(2)

APPENDIX B

I-69 Soil Boring Data
Wells-Allen County Line to Ellison, Indiana

The soil test data tabulated below was taken from a consultants report to the Indiana State Highway Commission. Site numbers listed below correspond to numbered site locations along I-69 shown on the attached engineering soils map. Only the sites referred to in the text have test data tabulated below. Considerable additional data can be obtained from the consultants report (18) but it is essentially similar to, or repetitious of, that listed below. Other ISHC data (19) (20) (21).

SITE	STATION	OFFSET (FT.)	DEPTH (FT.)	AASHO CLASS	TEXTURE	PERCENT SAND	SILT	CLAY	LL	PI	LAND-FORM*
17	485+00	42L	0-4	A-6 (10)	Clay Loam	26	47	27	36	15	FP
			4-6	A-2-4 (0)	Sandy Loam	79	15	6	25	NP	
18	497+00	42L	0-4	A-6 (9)	Clay	36	26	38	35	19	T
			4-6	A-4 (5)	Loam	39	46	15	21	5	
19	500+0	42R	0-2	A-6 (13)	Clay	12	43	45	40	23	T
			2-8	A-4 (2)	Sandy Clay Loam	57	22	21	24	8	
			8-10	A-2-4 (0)	Sandy Loam	73	15	12	17	5	
22	524+00	42R	0-2	A-7-6 (10)	Clay Loam	32	39	29	42	18	FP
			2-6	A-4 (3)	Loam	48	33	19	26	1	
23	525+00	42L	0-2	A-7-6	Clay						FP
			2-4	A-2-6 (0)	Sand	84	11	5	29	11	
			4-10	A-2-4 (0)	Sand	95	0	5	27	10	
			10-12	A-6	Clay						
24	529+47	42L	0-2	A-7-6 (13)	Clay	28	27	45	47	19	FP
			2-4	A-4	Loam						
			4-6	A-4 (3)	Sandy Loam	52	42	6	15	4	
25	534+00	42R	1-3	A-6 (8)	Clay Loam	45	29	26	37	19	RM
			3-7	A-6 (9)	Clay	28	35	37	33	16	
			7-9	A-6 (8)	Clay	38	29	33	31	17	
			9-21	A-6 (9)	Clay	25	34	41	26	12	
32	607+00	42R	0-2	A-6 (10)	Clay	18	38	44	32	14	RM
			2-6	A-4 (6)	Clay Loam	34	40	26	27	10	
			6-20	A-6 (9)	Clay	22	40	38	30	13	
45	785+00	42R	0-2	A-6 (8)	Loam	38	49	13	33	16	RM
			2-4	A-7-6 (15)	Clay	15	35	50	47	23	
			4-20	A-6 (9)	Clay	25	25	50	29	12	

*FP - flood plain; T - terrace; RM - ridge moraine
LP - lacustrine plain; OWP - outwash plain; PM - peat and muck

ITE	STATION	OFFSET (FT.)	DEPTH (FT.)	AASHO CLASS	TEXTURE	PERCENT SAND	SILT	CLAY	LL	PI	LAND-FORM
49	827+00	42R	0-2	A-6 (12)	CLAY	15	45	40	37	20.5	RM
			2-6	A-6 (11)	SILTY CLAY	14	52	34	36	18	
			6-22	A-6 (8)	CLAY	16	25	59	30	11	
			22-26	A-2-4 (0)	SAND	87	0	13	18	9	
50	830+00	42L	0-4	A-6 (9)	CLAY LOAM	26	47	27	32	13	OWP
			4-10	A-6 (9)	CLAY						
			10-16	A-2-4 (0)	SAND	80	1	19	27	9	
51	833+00	42R	2-4	A-1-b	SAND	85	1	14	15	NP	OWP
			4-8	A-4	SANDY CLAY LOAM	58	19	23	28	NP	PM
			8-20	A-1-b	SAND	89	8	3	18	NP	
52	849+00	42L	2-4	A-6 (5)	SANDY CLAY LOAM	51	20	29	33	17	LP
			4-6	A-4 (5)	CLAY LOAM	41	37	22	22	9	
53	851+00	42L	2-4	A-7-6 (13)	CLAY	18	47	35	41	22	
			4-6	A-4	CLAY LOAM						
54	851+00	42R	0-4	A-7-6 (18)	CLAY	28	33	39	54	30	LP
			4-6	A-4 (1)	SANDY LOAM	59	24	17	21	8	
55	852+00	42L	0-2	A-7-6 (10)	CLAY LOAM	48	27	25	47	25	LP
			2-6	A-6 (9)	CLAY	26	32	42	28	13	
			6-14	A-1-a	SAND	98	1	1	16	4	
			14-18	A-1-b	SANDY LOAM	78	11	11	15	3	
			18-20	A-1-a	SAND						
64	884+00	42R	2-4	A-4 (1)	SANDY CLAY LOAM	58	20	22	24	8	LP
			4-6	A-2-4 (0)	SANDY LOAM	71	19	10	21	3	
65	893+00	42L	0-2	A-4 (2)	SANDY CLAY LOAM	53	26	21	26	7	LP-OWP
			2-4	A-2-6 (0)	SAND	96	0	4	25	13	Contact
			4-6	A-4 (6)	CLAY LOAM	37	43	20	31	7	
66	893+00	42R	0-8	A-6 (6)	CLAY	40	27	33	31	13	LP-OWP Contact
			8-12	A-4 (1)	SANDY LOAM	60	25	15	12	0	
			12-14	A-4 (8)	SILTY CLAY	0	53	47	29	10	
67	900+00	42L	0-2	A-7-6 (13)	CLAY LOAM	36	34	30	49	26	LP-OWP-PM
			2-8	A-7-6 (11)	CLAY	22	27	51	41	17	Contact
			8-10	A-4 (1)	SANDY LOAM	58	23	19	26	8	
			10-12	A-7-6 (8)	CLAY	22	33	45	48	31	

ITE	STATION	OFFSET (FT.)	DEPTH (FT.)	AASHO CLASS	TEXTURE	PERCENT SAND	SILT	CLAY	LL	PI	LAND-FORM
68	904+00	42R	1-2.5	A-7-6 (18)	CLAY	20	30	50	50	30	PM-ONP
			3.5-5	A-6 (1)	CLAY LOAM	38	32	30	40	23	Contact
			6-7.5	A-2-4 (0)	SANDY LOAM	79	12	12	NL	NP	
			8.5-10	A-3	SAND						
			13.5-15	A-3 (0)	SAND	99	1	0	NL	NP	
			15.5-17	A-7-6 (11)	SILTY CLAY	2	64	34	41	18	
69	907+00	42R	1-5	A-7-6 (11)	CLAY	39	31	30	42	23	PM
			6-10	A-4 (0)	SANDY LOAM	64	18	18	22	2	
			13.5-15	A-7-6 (13)	CLAY	6	21	73	43	22	
			18.5-20	A-1-6	SAND	90	9	1	NL	NP	
70	908+00	42L	1-5	A-7-6	CLAY						PM
			6-10	A-6 (5)	CLAY LOAM	47	28	25	25	11	
			13.5-15	A-2-4	SANDY LOAM						
			19.5-21	A-7-6	CLAY						
71	910+00	42L	0-10	A-7-6 (16)	CLAY	17	37	46	47	26	PM
			10-16	A-4 (2)	SANDY CLAY LOAM	55	23	22	NL	NP	
			16-18	A-1-6 (0)	SAND	83	10	7	NL	NP	
			18-20	A-7-6 (13)	CLAY	0	25	75	43	20	
			20-24	A-6 (10)	CLAY	10	26	64	39	14	
72	913+00	42L	4-6	A-7-6 (12)	MARL (LOAM)	35	46	19	43	25	PM
73	915+00	42R	1-2.5	A-7-6 (14)	SILTY CLAY	11	53	36	42	23	PM
			3.5-5	A-6 (6)	CLAY LOAM	47	23	30	32	16	
			6-10	A-2-4 (0)	SANDY LOAM	76	18	6	25	5	
			13.5-15	A-1-b	SAND	99	1	0	NL	NP	
			18.5-22	A-7-6 (15)	CLAY	0	22	78	48	23	

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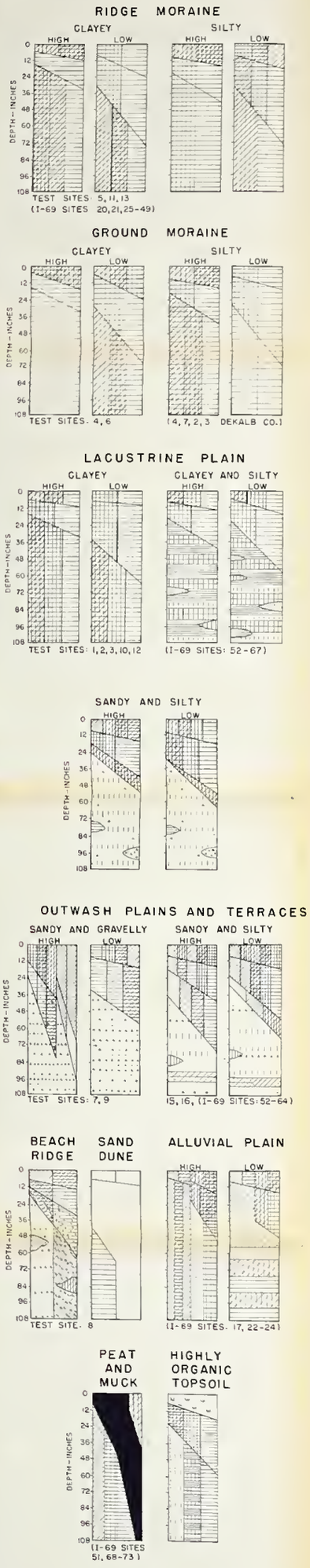
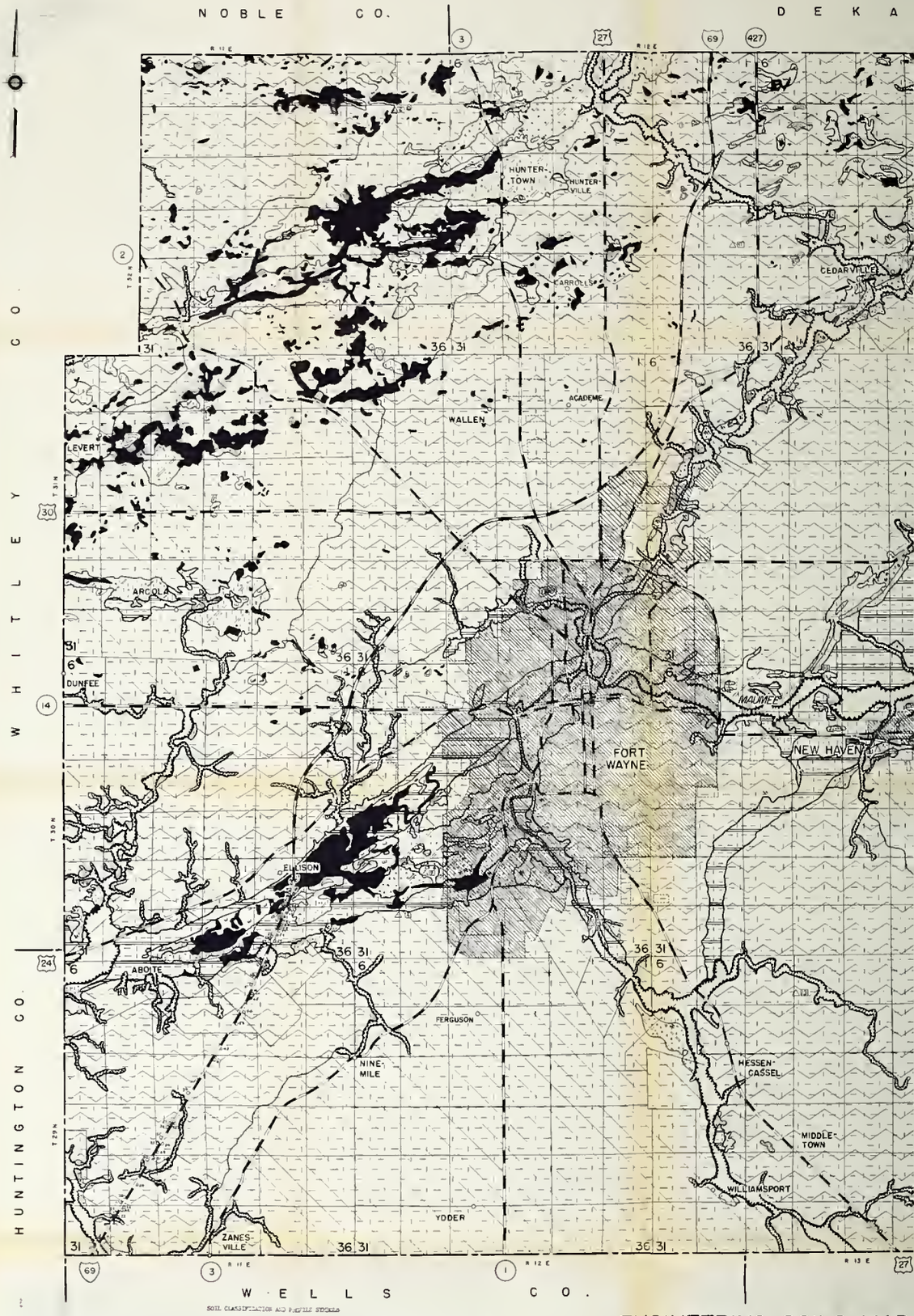
GENERAL SOIL PROFILES



PREPARED UNDER THE SUPERVISION OF: D G SHURIG



SOIL CLASSIFICATION AND PROFILE SYMBOLS

Description	Grain Size Distribution: Gravel % retained on #10	Sand % retained #10-#200	Silt % retained 0.05-0.005mm	Clay Less than 0.005mm	Plastic Index	Symbol
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-75	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Organic Matter						
Top Soil						

ENGINEERING SOILS MAP

ALLEN COUNTY

INDIANA

PREPARED FROM

1938 AND 1951 AERIAL PHOTOGRAPHS

BY

PURDUE UNIVERSITY
JOINT HIGHWAY RESEARCH PROJECT

IN COOPERATION WITH

BUREAU OF PUBLIC ROADS
SOIL CONSERVATION SERVICE

1966

SCALE OF MILES

1 3/4 1/2 1/4 0 1 2 3 4

	Plastic Index	Symbol
	NP	
	6 Max.	
	13	
	6 Max.	
	6 Max.	
	10 Max.	
	11 Min.	
	10 Max.	
	10 Max.	
	11 Min.	
	11 Min.	
	11 Min.	
	11 Min.	

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1966

SCALE OF MILES

1 3/4 1/2 1/4 0 1 2 3 4

LEGEND

PARENT MATERIALS

(GROUPED ACCORDING TO LAND FORM AND ORIGIN)

- RIDGE MORAINE
- GROUND MORAINE
- OUTWASH PLAIN
- LACUSTRINE PLAIN
- BEACH RIDGE
- TERRACE
- ALLUVIAL PLAIN
- PEAT AND MUCK
- SAND DUNE

TEXTURAL SYMBOLS

(SUPERIMPOSED ON PARENT MATERIAL SYMBOLS TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

MISCELLANEOUS

- GRAVEL PIT (LS - LIMESTONE, CL - CLAY)
- LAKE AND POND
- HIGHLY ORGANIC TOPSOIL
- SOIL SAMPLING SITE

DRAWN BY W. L. OEHLMAN